



National Aeronautics and
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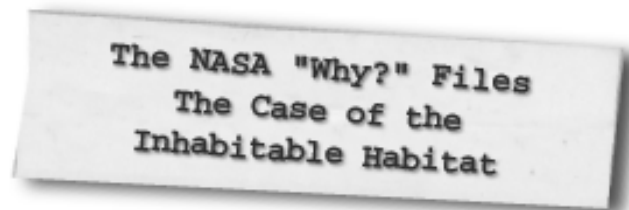
Langley Research Center
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Educational Product

Educators

Grades 3-5

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**A Lesson Guide with Activities in
Mathematics, Science, and Technology**

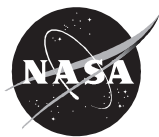
In our title, the word inhabitable describes a place (a habitat) in which human beings and other living creatures have what they need to survive.

For human beings and other living creatures on Earth to survive in alien environments such as oceans, deserts, or outer space, the basic requirements for

life must exist or be made available.

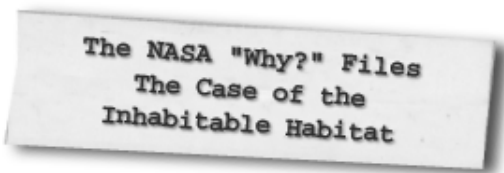
There must be oxygen, water, protective clothing, shelter, and food, to name only a few of the necessities. Habitats created for human, animal, and plant life in outer space or in other, as yet unknown environments, must have the life-supporting essentials that people and other living creatures need for survival.

Scientists are now studying ways to create habitats in space where human beings can live and work. Someday, perhaps people and animals will live on other planets or in underwater cities in the Earth's oceans. Life-sustaining habitats must be created so that we can adapt to environments unlike those of the Earth.



The Case of the Inhabitable Habitat lesson guide is available in electronic format through NASA Spacelink - one of NASA's electronic resources specifically developed for the educational community. This publication and other educational products may be accessed at the following address: **<http://spacelink.nasa.gov/products>**

A PDF version of the lesson guide for NASA "Why?" Files can be found at the NASA "Why?" Files web site: **<http://whyfiles.larc.nasa.gov>**



A Lesson Guide with Activities in Mathematics, Science, and Technology

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For additional information about the NASA "Why?" Files, contact Shannon Ricles at (757) 864-5044 or e-mail s.s.ricles@larc.nasa.gov.

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 Registered users of the NASA "Why?" Files may request an American Institute of Aeronautics and Astronautics (AIAA) classroom mentor. For more information or to request a mentor, e-mail nasawhyfiles@aiaa.org.



Program Overview

In *The Case of the Inhabitable Habitat*, the tree house detectives accept the challenge of designing a habitat that can sustain life on Mars. To design an award winning habitat, the tree house detectives decide that they must first learn more about the planet Mars and the various habitats found here on Earth.

As they begin their investigation, the tree house detectives go to NASA Langley Research Center in Hampton, Virginia to learn more about Mars, the red planet, from Dr. Levine. They also visit Dr. D, a retired science professor, for advice on where to start their habitat research. With his direction, the tree house detectives go on many excursions to speak with

various NASA researchers and community experts. They also get a little help from two NASA "Why?" Files Kids Clubs in Houston, Texas and Silver Spring, Maryland.

Kali, one of the tree house detectives, is concerned about the fish in the local bay. They all seem to have disappeared. While conducting their investigation, the tree house detectives use the information they have learned about the basic needs of plants and animals not only to design a very "Martian" habitat, but also to solve the mystery of the missing fish! Along the way, they learn that their "habits" have a big impact on their habitat.

National Geography Standards (grades 3-5)

Standard	Segment			
	1	2	3	4
The geographically informed person knows and understands				
The World in Spatial Terms				
How to use maps and other graphic representations, tools, and technologies to acquire, process, and report information from a spatial perspective		x		x
Physical Systems				
The physical process that shapes the patterns of Earth's surface	x	x		
The characteristics and spatial distribution of ecosystems on Earth's surface	x	x	x	x
Environment and Society				
How physical systems affect human systems	x	x	x	x
Uses of Geography				
How to apply geography to interpret the past				x
How to apply geography to interpret the present and plan for the future				x

National Science Standards (Grades K – 4)

Standard	Segment			
	1	2	3	4
Unifying Concepts and Processes				
Systems, orders, and organization	X	X	X	X
Evidence, models, and explanations	X	X	X	X
Evolution and equilibrium			X	X
Form and function	X	X	X	X
Science and Inquiry (Content Standard A)				
Abilities necessary to do scientific inquiry	X	X	X	X
Understandings about scientific inquiry	X	X	X	X
Life Science (Content Standard C)				
Characteristics of organisms	X	X	X	X
Life cycles of organisms		X		X
Organisms and their environments	X	X	X	X
Earth and Space Science (Content Standard D)				
Properties of Earth materials	X	X		
Objects in the sky	X			
Science and Technology (Content Standard E)				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X
Abilities to distinguish between natural objects and objects made by human beings	X	X	X	X
Science in Personal and Social Perspective (Content Standard F)				
Personal health	X	X	X	X
Characteristics and changes in population	X			
Types of resources	X	X	X	X
Changes in environment	X	X	X	X
Science and technology in local challenges	X	X	X	X
History and Nature of Science (Content Standard G)				
Science as a human endeavor	X	X	X	X



National Science Standards (Grades 5 – 8)

Standard	Segment			
	1	2	3	4
Unifying Concepts and Processes				
Systems, order, and organization	X	X	X	X
Evidence, models, and explanations	X	X	X	X
Evolution and equilibrium			X	X
Form and function	X	X	X	X
Science as Inquiry (Content Standard A)				
Abilities necessary to do scientific inquiry	X	X	X	X
Understanding about scientific inquiry	X	X	X	X
Physical Science (Content Standard B)				
Motion and forces			X	X
Life Science (Content Standard C)				
Regulation and behavior	X	X	X	X
Populations and ecosystems	X	X	X	X
Diversity and adaptations of organisms	X	X		
Earth and Space Science (Content Standard D)				
Earth in the solar system	X		X	X
Science and Technology (Content Standard E)				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X
Science in Personal and Social Perspectives (Content Standard F)				
Personal health		X	X	
Populations, resources, and environments				X
Natural hazards			X	
Science and technology in society	X	X	X	X
History and Nature of Science (Content Standard G)				
Science as a human endeavor	X	X	X	X
Nature of science	X	X	X	X
History of science			X	

National Mathematics Standards (Grades 3 – 5)

Standard	Segment			
	1	2	3	4
Geometry				
Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	X	X	X	X
Use visualization, spatial reasoning, and geometric modeling to solve problems.	X	X	X	X
Measurement				
Understand measurable attributes of objects and the units, systems, and processes of measurement.	X	X	X	X
Apply appropriate techniques, tools, and formulas to determine measurements.	X	X	X	X
Data Analysis and Probability				
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	X	X	X	X
Develop and evaluate inferences and predictions that are based on data.	X	X	X	X
Understand and apply basic concepts of probability.	X	X	X	X
Problem Solving				
Build new mathematical knowledge through problem solving.	X	X	X	X
Monitor and reflect on the process of mathematical problem solving.	X	X	X	X



National Technology Standards (ITEA Standards for Technology Literacy, Grades 3 – 5)

Standard	Segment			
	1	2	3	4
Nature of Technology				
Standard 1: Students will develop an understanding of the characteristics and scope of technology.	X	X	X	X
Standard 2: Students will develop an understanding of the core concepts of technology.	X	X	X	X
Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	X	X	X	X
Technology and Society				
Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology.	X	X	X	X
Standard 5: Students will develop an understanding of the effects of technology on the environment.				X
Standard 6: Students will develop an understanding of the role of society in the development and use of technology.	X	X	X	X
Standard 7: Students will develop an understanding of the influence of technology on history.	X	X	X	X
Design				
Standard 8: Students will develop an understanding of the attributes of design.	X	X	X	X
Standard 9: Students will develop an understanding of engineering design.	X	X	X	X
Standard 10: Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving.	X	X	X	X
Abilities for a Technological World				
Standard 11: Students will develop the abilities to apply the design process.		X	X	X
Standard 12: Students will develop abilities to use and maintain technological products and systems.	X	X	X	X
The Designed World				
Standard 15: Students will develop an understanding of and be able to select and use agricultural and related biotechnologies.		X		
Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.	X	X	X	X
Standard 20: Students will develop an understanding of and be able to select and use construction technology.	X	X	X	X

National Technology Standards (ISTE National Educational Technology Standards, Grades 3 – 5)

Standard	Segment			
	1	2	3	4
Basic Operations and Concepts				
Use Keyboards and other common input and output devices efficiently and effectively.	X	X	X	X
Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide.	X	X	X	X
Technology Productivity Tools				
Use general purpose productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum.	X	X	X	X
Use technology tools for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.	X	X	X	X
Technology Communication Tools				
Use technology tools for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.	X	X	X	X
Use telecommunication efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests.	X	X	X	X
Use telecommunication and online resources to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	X	X	X	X
Technology Research Tools				
Use telecommunication and online resources to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	X	X	X	X
Use technology resources for problem solving, self-directed learning, and extended learning activities.	X	X	X	X
Determine when technology is useful and select the appropriate tools and technology resources to address a variety of tasks and problems.	X	X	X	X
Technology Problem-Solving and Decision-Making Tools				
Use technology resources for problem solving, self-directed learning, and extended learning activities.	X	X	X	X



The NASA "Why?" Files
The Case of the
Inhabitable Habitat

Segment 1

Jacob finds Kali walking along the beach contemplating what has happened to all the fish. They are gone! Jacob is not worried about the fish problem but is excited about a new contest offered by the Young Astronauts Club at school. He wants the tree house detectives to enter the contest because he knows they can win. After all, they are the "tree house detectives!" However, this contest could be a little more difficult than the other contests because they have to build a habitat to sustain human life on Mars. That is not an easy challenge!

The tree house detectives decide they should first find out more about Mars before they begin to design a habitat. They start their investigation with a search of the NASA Langley Research Center's web site and locate Dr. Levine, a Mars expert. Dr. Levine helps the tree house detectives understand that Mars is very different from Earth and they will need to consider many different factors before beginning their design. Dr. Levine also suggests that they might want to learn a little more about habitats.

A vacation retreat planned for the Discovery Cove in Orlando, Florida is the perfect place for the tree house detectives to learn exactly what a habitat is and what "basic needs" are. After speaking with an expert at Discover Cove and swimming with the dolphins, the tree house detectives are sure they understand habitats and are eager to get home to start their project. Armed with their new knowledge, the tree house detectives head to Dr. D's lab where they find out that they just might need to learn a little bit more before they "dive" into the project.

Objectives

The students will

- compare and contrast Earth and Mars.
- understand that organisms have basic needs.
- understand that organisms only survive when needs are met.
- learn how different environments support different organisms.
- understand that animals and plants need to adapt to survive.

Vocabulary

atmosphere - a mass of gases surrounding a heavenly body such as a planet

biome - a complex community of plants and animals living in a particular geographical area with a particular climate

carbon dioxide - a heavy colorless gas that does not support burning, dissolves in water to form carbonic acid, is formed especially by the burning and breaking down of organic substances (as in animal respiration), is absorbed from the air by plants in photosynthesis, and has many industrial uses

environment - all circumstances surrounding an organism or group of organisms. Circumstances may include a whole complex of factors (such as soil,

climate, and living things) that influence the form and the ability of a plant, animal, or ecological community to survive

gravity - force of attraction between all objects in the universe

habitat - any place where organisms live, grow, and interact

inhabit - to live in a place

Mars - third planet from the Sun

terrarium - a small enclosure or container, often of glass, used for growing plants or raising small land animals, such as snakes, turtles, or lizards

Video Component

Implementation Strategy

The NASA "Why?" Files is designed to enhance and enrich the existing curriculum. Two to three days of class time are suggested for each segment to fully use video, resources, activities, and the web site.

Before Viewing

1. Prior to viewing Segment 1 of *The Case of the Inhabitable Habitat*, read the program overview (p. 5) to the students. List and discuss questions and preconceptions that students may have about Mars and habitats.
2. Record a list of issues and questions that the students want answered in the program. Determine why it is important to define the problem before beginning. From this list, guide students to create a class or team list of three issues and four questions that will help them to

better understand the problem. The following tools are available on the web site to assist in the process.

Problem Board - Printable form to create student or class K-W-L chart

PBL Questions - Questions for students to use while conducting research

Problem Log - Printable log for students with the stages of the problem-solving process

The Scientific Method - Chart that describes the scientific method process

3. Focus Questions - Questions at the beginning of each segment help students focus on a reason for viewing. These can be printed from the web site ahead of time for students to copy into their science journals. Encourage students to take notes during the program so they will be able to answer the questions.



View Segment 1 of the Video

For optimal educational benefit, view "The Case of the Inhabitable Habitat" in 15-minute segments and not in its entirety.

After Viewing

1. Have students reflect on the "What's Up?" questions asked at the end of the segment.
2. Students should work in groups or as a class to discuss and list what they know about Mars and habitats. As a class, they should reach a consensus on what additional information they need to know about habitats and Mars before designing a habitat. Have the students conduct independent research or provide students with the information needed. Visit the NASA "Why?" Files web site for an additional list of resources for both students and educators.
3. Have students discuss possible designs for their own Mars habitat.
4. Choose activities from the educator guide and web site to reinforce concepts discussed in the segment. The variety of activities is designed to

Careers

Oceanographer
Marine biologist
Fisherman
Zoologist

enrich and enhance the curriculum. Activities also help students "solve" the problem along with the tree house detectives.

5. Have the students work individually, in pairs, or in small groups on the Problem-Based Learning (PBL) activity on the NASA "Why?" Files web site.
6. To begin the PBL activity, read the scenario to the students.
7. Read and discuss the various roles involved in the investigation. Have each student choose his/her role.
8. Print the criteria for the investigation and distribute.
9. Have students use the Research Rack located on the web site and the online tools that are available.
10. Having students write in their journals what they have learned from this segment and from their own experimentation and research is one way to assess the students. In the beginning, students may have difficulty reflecting. To help students, give them specific questions to reflect upon related to the concepts.
11. The NASA "Why?" Files web site provides teachers with check lists and rubrics that may assist you in assessment.

Resources (additional resources located on web site)

Books

Arnosky, Jim: *Crinkleroot's Guide to Knowing Animal Habitats*. Aladdin Paperbacks, 2000, ISBN: 0689835388.

Davies, Nicola and Nic Davies: *Dolphin: Habitats, Life Cycles, Food Chains, Threats*. Raintree/Steck Vaughn, 2000, ISBN: 0739827669.

Hewitt, Sally: *All Kinds of Habitats (It's Science)*. Children's Press, 1999, ISBN: 0516211811.

Paige, David: *A Day in the Life of a Marine Biologist*. Troll Associates, 1981, ISBN: 0893754463.

Ride, Sally and Tam O'Shaughnessy: *The Mystery of Mars*. Crown Publishing, 1999, ISBN: 0517709724.

Sipiera, Paul P.: *I Can Be an Oceanographer*. Children's Press, 1987, ISBN: 0516019058.

Web Sites

Mars Airplane—100 Years of Powered Flight

View photographs of the Martian landscape and learn what future travel will be available when we travel to the planet Mars.

<http://marsairplane.larc.nasa.gov/>

Mars Team Online—Kids' Corner

Play a Mars memory match, solve a slider puzzle, or create your own Mars pathfinder scale model and much more at this web site.

<http://quest.arc.nasa.gov/mars/kids/index.html>

Mars Education

Web site that is a useful resource for students, teachers, and parents. Students can download printable images to create your own Mars Pathfinder model and much more.
<http://marsnt3.jpl.nasa.gov/education/index.html>

Mars

A comprehensive web site with everything you want to know about Mars.
<http://www.seds.org/nineplanets/nineplanets/mars.html>

SeaWorld™

Whether it's coming face to face with polar bears, feeding dolphins by sunset, or braving the "Great White" coaster, SeaWorld will take you to extremes!
<http://seaworld.com/>

Science@NASA News Article: Bizarre Boiling

Read how NASA researchers conducted experiments onboard the Space Shuttle to determine the differences between what happens to boiling fluids on Earth and what happens to them in orbit. See a Quicktime™ video of these experiments and more.
http://science.nasa.gov/headlines/y2001/ast07sep_2.htm

Ranger Rick's Kids Zone

Become a junior wildlife expert at the National Wildlife Federation web site. Here kids can learn what is best for wild animals and their environments, journey through wetlands, and learn about endangered species. Explore a habitat with the "Thank a Tree" game and enjoy much more.
<http://www.nwf.org/kids/index.html>

National Geographic for Kids

Visit Creature Feature and learn about more than 20 different animals while reading facts and watching Quicktime™ videos. Read some pretty amazing facts or laugh at the jokes and tongue twisters in Fun & Games. Go to Family Xpeditions and find printable maps of almost any place on Earth. You can even get help with your homework!
<http://www.nationalgeographic.com/kids/>

Activities and Worksheets

In the Guide	Earth Versus Mars	
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	How Fast Does It Need To Go?	
	Calculate the time it would take to travel to Mars at various speeds	16
	Biomes	
	Learn about the major biomes of Earth	17
	Welcome to My Habitat	
	Learn about various habitats and create a habitat in a shoebox	18
	Don't Burst My Bubble	
	Create a large bubble habitat for the classroom or home	19
	How Does Your Garden Grow	
	Create a mossy garden in a bottle	20
On the Web	Wish You Were Here!	
	Create a travel brochure or presentation to attract tourist to Mars	



Earth Versus Mars

Problem

To compare and contrast Earth and Mars

Procedure

1. Using various books, encyclopedias, and internet sites, fill in the missing information in the data chart.
2. Continue to research and add additional information to the chart or in your science journal.
3. Sort all information into categories.
4. Create a Venn diagram, chart, graph, or other representation to share with the class to show how Earth and Mars are alike and different.

Materials

various references on
Mars and Earth
science journal
pencil

Data Chart

PERTINENT INFORMATION	EARTH	MARS
Distance from Sun in Millions of km	149.6	
Diameter (km)		6,794
Volume (Earth = 1)	1	0.149
Orbital Tilt	23.45	25.19
Average Temperature at Surface	15° C	
Gravity	1	0.38
Length of Year	365 Earth Days	Earth Days
Length of Day	24 Earth Hours	Earth Hours
Number of Moons (Satellites)		

How Fast Does It Need to Go?

Problem

To calculate the time it would take to reach Mars traveling at various speeds

Materials

calculator
pencil

Procedure

1. Mars is approximately 78,000,000 kilometers from Earth.
2. Use a calculator and the formulas in the chart below to determine how long it would take to reach Mars at the various speeds. Be sure to round to the nearest whole number. The first one is done for you.
3. Calculate your age if you traveled to Mars at that speed.

Travel Speed in km per hour (km/h)	Hours	Days	Months	Years	Age on Arrival
	<u>Distance</u> <u>Speed</u>	<u>Hours</u> <u>24</u>	<u>Days</u> <u>30</u>	<u>Month</u> <u>12</u>	<u>Years +</u> <u>Your Age</u>
Walking 3.6 km/h	$\frac{78,000,000}{3.6}$ =21,666,667	$\frac{21,666,667}{24}$ = 902,778	$\frac{902,778}{30}$ = 30,093	$\frac{30,093}{12}$ = 2,508	2,508 + 9 = 2,517
Running 7.5 km/h					
Bicycling 13.2 km/h					
Car 80 km/h					
Jet Airplane 1500 km/h					
Rocket 40,000 km/h					
Space Shuttle ____ km/h					



Conclusion

1. Which forms of travel allow you to reach Mars in your lifetime? _____
2. To reach Mars in your lifetime, what would be the minimum speed you could travel? What factors need to be considered? _____

3. Determine the speed of a space shuttle and calculate.

Biomes

Problem

To learn about the major biomes

Procedure

1. In your group, research your assigned biome: tundra, grassland, tropical rain forest, coniferous forest, deciduous forest, desert, freshwater, or marine.
2. In your science journal, record the types of plants and animals that live in each biome and describe its important features.
3. Present your biome to the class by illustrating it on construction paper, creating a diorama or Power Point presentation, or any other way you choose.

Materials

reference books, encyclopedias,
or internet web sites
pencil
colored pencils or markers
science journal
various objects needed for
presentation

Extensions

1. On a world map locate the three major forest biomes.
2. Compare and contrast them. Describe the location and climate (temperature and rainfall), and give examples of vegetation, animals, and birds of each.
3. Compare and contrast land biomes to marine or freshwater biomes.
4. Research what makes a desert unique and discuss desertification.



Welcome to My Habitat

Problem

To learn the various plants, animals, and physical characteristics of different habitats

Procedure

1. Determine the type of habitat you will present. It can be any land, freshwater, or saltwater biome.
2. Research the habitat, and in your science journal, list the kinds of plants and animals found in the habitat and its physical characteristics. Make sure you have included all the basic needs.
3. Design your shoe box habitat on paper and make a list of items you will need to collect or bring from home.
4. Carefully cut a rectangular piece from the shoe box lid to create an opening. Tape a piece of blue cellophane over the entire opening. See diagram 1.
5. Using your design and collected items, construct the habitat inside the box. See diagram 2.
6. Using scissors or a hole-punch, punch a small hole in one end of the box to serve as a viewfinder. See diagram 3.
7. Place the lid on your habitat and look through the viewfinder.
8. Share your habitat with the class.

Extensions

1. Before sharing as a class, have students observe the other students' habitats and guess which habitat was illustrated.
2. Use large refrigerator size boxes to create a large habitat. Have each member of the group act as a ranger or ecology tour guide to explain one specific aspect of the habitat, such as the animal life, plant life, or characteristics. Invite other classes or parents for tours.

Materials

shoe box with lid
blue cellophane
scissors
crayons or markers
glue
hole-punch (optional)
various materials for chosen habitat

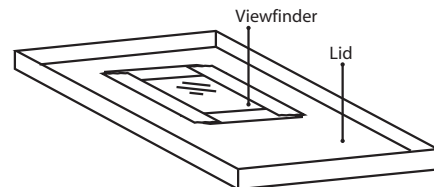


Diagram 1

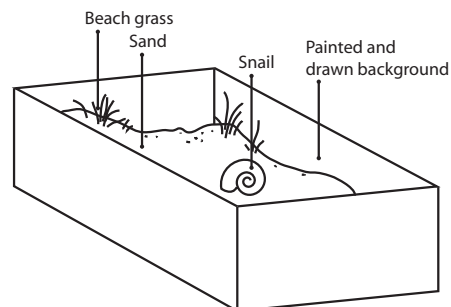


Diagram 2

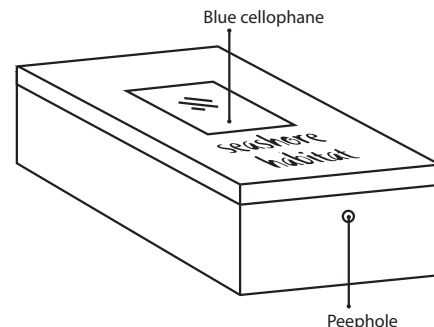


Diagram 3

Don't Burst My Bubble

Problem

To create a large classroom habitat

Procedure

To make the biome bubble:

1. Fold tarp in half, lining up the sides as evenly as possible.
2. Using strong tape, such as duct tape, tape the two pieces of tarp together on both shorter sides of the tarp. See diagram 1.
3. On the longer side of the tarp, leave an opening large enough to fit the box fan plus 1-meter. See diagram 2.
4. Place box fan at the far left of the opening in the tarp so that the air from the fan is blowing into the bubble. See diagram 3.
5. Tape the top layer of the tarp to the top of the box fan.

To create the habitat:

1. Have the class decide which habitat they would like to create.
2. Divide the class into groups to research the various aspects of the habitat. One group might be assigned to plants, another to animals, and so on.
3. Have the students artistically create the plants, animals, and physical characteristics of the habitat.
4. Use the fan to blow up the bubble and either have the students or the teacher place the plants, animals, and other items created in the bubble. Use tape and/or string to suspend items from the top of the bubble.
5. Invite other classes or parents to tour your habitat.

Extension

1. Use this large habitat to discuss and show how basic needs are met within a habitat.
2. Create a Martian habitat bubble!
3. Create a "hallway" habitat. Invite other classes to join you, with each class creating a different habitat.

Materials

large, clear, thick,
plastic tarp
strong tape
box fan
various art supplies
tape
string
hole punch

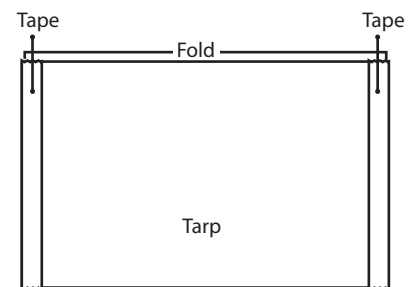


Diagram 1

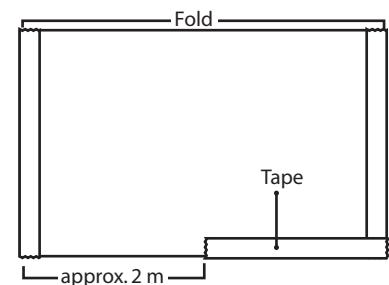


Diagram 2

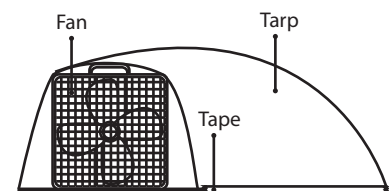


Diagram 3

How Does Your Garden Grow?

Problem

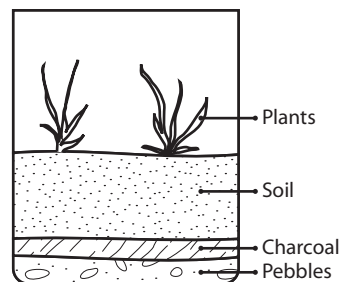
To create a mossy garden in a bottle

Procedure

1. In the bottom of the large bottle, spread a layer of pebbles.
2. Cover the pebbles with a layer of charcoal.
3. Cover the top of the charcoal with about a 10-cm layer of potting soil.
4. Press the soil down with either the spoon or your hand.
5. Using the spoon, dig a small hole for the first plant.
6. Gently place the plant into the bottle and cover the plant's roots with soil. Press the soil down firmly around the plant.
7. Repeat with the remaining plants arranging them attractively in the bottle.
8. Carefully pour a cup of water into the bottle.
9. Leave the bottle open and place it in a cool place where the light is good but not too bright. Avoid direct sunlight.
10. If you want, after there are no more drops of water on the inside of the glass, you can put a top on your bottle.
11. Care of your garden is minimal. Just spray it with water occasionally to keep the soil moist and snip off any dead leaves with a small pair of scissors.
12. Watch the ferns and mosses to see how they grow or change. Look for tiny spores or grass-like stems to see how they reproduce.

Materials

large, wide-mouthed bottle
small pebbles (about a 1/2 cup)
charcoal (about 1/2 cup)
peat-based potting soil
different types of moss, ferns, or lichens
1 cup of water
big spoon
spray bottle with water



Answer Key

How Fast Do You Need to Go?

Travel Speed in km per hour (km/h)	Hours	Days	Months	Years	Age on Arrival
	<u>Distance</u> Speed	<u>Hours</u> 24	<u>Days</u> 30	<u>Month</u> 12	Years + Your Age
Walking 3.6 km/h	$\frac{78,000,000}{3.6}$ =21,666,667	$\frac{21,666,667}{24}$ = 902,778	$\frac{902,778}{30}$ = 30,093	$\frac{30,093}{12}$ = 2,508	2,508 + 9 = 2,517
Running 7.5 km/h	10,400,000	433,333	14,444	1,204	
Bicycling 13.2 km/h	5,909,091	246,212	8,207	684	
Car 80 km/h	975,000	40,625	1,354	113	
Jet Airplane 1500 km/h	52,000	2,167	72	6	
Rocket 40,000 km/h	1,950	81	3	0.25 or 1/4 of a year	
Space Shuttle <u>29,000</u> km/h	2,690	112	4	0.33 or 1/3 of a year	

1. You could best reach Mars in your lifetime by traveling on a rocket or space shuttle. A jet airplane could travel to Mars in only 6 years, but it is not equipped for space travel.
2. If an average life span is about 80 years, and a student is about 10 years old, the student could travel at a minimum speed of around 150 km/h. Some factors for a traveler to consider would be how many supplies to carry for that length of time and whether the traveler would be in good health upon arrival. Would the traveler be able to conduct experiments?
3. See table above.